

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A purification device for reducing the amount of contaminants in water, said device comprising a water-soluble flocculant disposed within a body defining a multiplicity of pores, wherein the pores have an average diameter in the range of from 1 μm to 2000 μm .

2. The device of Claim 1 wherein the pores have an average diameter in the range of from 50 μm to 1000 μm .

3. The device of Claim 1 wherein the pores have an average diameter in the range of from 100 μm to 800 μm .

4. The device of Claim 1 wherein the body is stretchable.

5. The device of Claim 2 wherein the body is stretchable.

6. The device of Claim 3 wherein the body is stretchable.

7. The device of Claim 1 wherein the body is flexible.

8. The device of Claim 1 wherein the body is segmented.

9. The device of Claim 4 wherein the body is segmented.

10. The device of Claim 5 wherein the body is segmented.

11. The device of Claim 6 wherein the body is segmented.

12. The device of Claim 1 wherein the body is cylindrical.

13. The device of Claim 1 wherein the body is made from a woven fabric.

14. The device of Claim 1 further comprising means for attaching the device to a substrate.

15. The device of Claim 1 wherein the flocculant comprises a water-soluble cationic flocculant.

16. The device of Claim 15 wherein the water-soluble cationic flocculant is selected from the group consisting of a chitosan salt, a cationic N-halochitosan, a cationic gum, a cationic starch, and a cationic polyacrylamide.

17. The device of Claim 16 wherein the water-soluble cationic flocculant is a chitosan salt.

18. The device of Claim 17 wherein the chitosan salt has an average molecular weight in the range of from 20,000 Daltons to two million Daltons.

19. The device of Claim 17 wherein the chitosan salt has an average molecular weight in the range of from 50,000 Daltons to one million Daltons.

20. The device of Claim 17 wherein the chitosan salt has an average molecular weight in the range of from 100,000 Daltons to 900,000 Daltons.

21. The device of Claim 17 wherein the chitosan salt has a percentage deacetylation in the range of from 50% to 100%.

22. The device of Claim 17 wherein the chitosan salt has a percentage deacetylation in the range of from 60% to 95%.

23. The device of Claim 17 wherein the chitosan salt has a percentage deacetylation in the range of from 70% to 90%.

24. The device of Claim 17 wherein the chitosan salt is selected from the group consisting of chitosan lactate, chitosan glutamate, chitosan hydrochloride, chitosan succinate, chitosan fumarate, chitosan adipate, chitosan glycolate, chitosan tartrate, chitosan formate, chitosan malate, and chitosan citrate.

25. The device of Claim 16 wherein the water-soluble cationic flocculant is a cationic N-halochitosan.

26. The device of Claim 16 wherein the water-soluble cationic flocculant is a cationic gum.

27. The device of Claim 16 wherein the water-soluble cationic flocculant is a cationic starch.

28. The device of Claim 16 wherein the water-soluble cationic flocculant is a cationic polyacrylamide.

29. The device of Claim 1 wherein the flocculant consists essentially of a water-soluble cationic flocculant.

30. The device of Claim 29 wherein the water-soluble cationic flocculant is selected from the group consisting of a chitosan salt, a cationic N-halochitosan, a cationic gum, a cationic starch, and a cationic polyacrylamide.

31. The device of Claim 1 wherein the flocculant comprises a water-soluble anionic flocculant.

32. The device of Claim 31 wherein the anionic flocculant is selected from the group consisting of an anionic gum, an anionic starch and an anionic polyacrylamide.

33. The device of Claim 1 wherein the flocculant comprises a water-soluble cationic flocculant and a water-soluble anionic flocculant.

34. The device of Claim 33 wherein the device body comprises a first half and a second half, and more water-soluble anionic flocculant is disposed within the first half of the body than within the second half of the body.

35. The device of Claim 34 wherein at least 90% of the water-soluble anionic flocculant is disposed within the first half of the body.

36. The device of Claim 34 wherein at least 99% of the water-soluble anionic flocculant is disposed within the first half of the body.

37. The device of Claim 1 wherein:

(a) the water-soluble flocculant consists essentially of a cationic chitosan salt, said cationic chitosan salt having a molecular weight in the range of from 20,000 Daltons to two million Daltons, and a percentage deacetylation in the range of from 50% to 100%;

(b) the body is segmented and flexible; and

(c) the pores have an average diameter in the range of from 100 μm to 800 μm .

38. A method for reducing the amount of contaminants in water, said method comprising the steps of:

(a) at least partially immersing a purification device in running water, wherein

(1) the purification device comprises a water-soluble flocculant disposed within a body defining a multiplicity of pores, wherein the pores have an average diameter in the range of from 1 μm to 2000 μm ;

(2) the water comprises a contaminant;

(3) the purification device is at least partially immersed in the running water under conditions whereby at least a portion of the flocculant is dissolved in the water and binds to at least some of the contaminant to form water-insoluble complexes; and

(b) removing at least some of the water-insoluble complexes from the water.

39. The method of Claim 38 wherein the water comprising a contaminant has a turbidity of from 50 to 10,000 Nephelometric Turbidity Units before treatment in accordance with the method of Claim 38.

40. The method of Claim 38 wherein the water comprising a contaminant has a turbidity of from 500 to 1000 Nephelometric Turbidity Units before treatment in accordance with the method of Claim 38.

41. The method of Claim 38 wherein the water comprising a contaminant has a starting concentration of the contaminant before treatment of the water in accordance with the method of Claim 38, and an ending concentration of the contaminant after treatment of the water in accordance with the method of Claim 38, and the value of the

ending concentration of the contaminant is less than 75% of the value of the starting concentration of the contaminant.

42. The method of Claim 41 wherein the value of the ending concentration of the contaminant is less than 50% of the value of the starting concentration of the contaminant.

43. The method of Claim 41 wherein the value of the ending concentration of the contaminant is less than 25% of the value of the starting concentration of the contaminant.

44. The method of Claim 41 wherein the value of the ending concentration of the contaminant is less than 10% of the value of the starting concentration of the contaminant.

45. The method of Claim 38 wherein the pH of the water comprising a contaminant is from 6.5 to 8.5 before treatment in accordance with the method of Claim 38.

46. The method of Claim 38 wherein the removal of at least some of the water-insoluble complexes is by biofiltration.

47. The method of Claim 38 wherein the removal of at least some of the water-insoluble complexes is by sand filtration.

48. The method of Claim 38 wherein the removal of at least some of the water-insoluble complexes is by sedimentation.

49. The method of Claim 38 wherein the purification device body is flexible.

50. The method of Claim 38 wherein the purification device body is segmented.

51. The method of Claim 38 wherein the purification device body is stretchable.

52. The method of Claim 49 wherein the purification device body is stretchable.

53. The method of Claim 50 wherein the purification device body is stretchable.

54. The method of Claim 38 wherein the purification device body is made from a woven fabric.

55. The method of Claim 38 wherein the pores have an average diameter in the range of from 50 μm to 1000 μm .

56. The method of Claim 38 wherein the pores have an average diameter in the range of from 100 μm to 800 μm .

57. The method of Claim 38 wherein the purification device further comprises means for attaching the device to a substrate.

58. The method of Claim 38 wherein the flocculant comprises a water-soluble cationic flocculant.

59. The method of Claim 58 wherein the water-soluble cationic flocculant is selected from the group consisting of a chitosan salt, a cationic N-halochitosan, a cationic gum, a cationic starch, and a cationic polyacrylamide.

60. The method of Claim 59 wherein the water-soluble cationic flocculant is a chitosan salt.

61. The method of Claim 60 wherein the chitosan salt has an average molecular weight in the range of from 20,000 Daltons to two million Daltons.

62. The method of Claim 60 wherein the chitosan salt has an average molecular weight in the range of from 50,000 Daltons to one million Daltons.

63. The method of Claim 60 wherein the chitosan salt has an average molecular weight in the range of from 100,000 Daltons to 900,000 Daltons.

64. The method of Claim 60 wherein the chitosan salt has a percentage deacetylation in the range of from 50% to 100%.

65. The method of Claim 60 wherein the chitosan salt has a percentage deacetylation in the range of from 60% to 95%.

66. The method of Claim 60 wherein the chitosan salt has a percentage deacetylation in the range of from 70% to 90%.

67. The method of Claim 60 wherein the chitosan salt is selected from the group consisting of chitosan lactate, chitosan glutamate, chitosan hydrochloride, chitosan succinate, chitosan fumarate, chitosan adipate, chitosan glycolate, chitosan tartrate, chitosan formate, chitosan malate, and chitosan citrate.

68. The method of Claim 59 wherein the water-soluble cationic flocculant is a cationic N-halochitosan.

69. The method of Claim 59 wherein the water-soluble cationic flocculant is a cationic gum.

70. The method of Claim 59 wherein the water-soluble cationic flocculant is a cationic starch.

71. The method of Claim 59 wherein the water-soluble cationic flocculant is a cationic polyacrylamide.

72. The method of Claim 38 wherein the flocculant consists essentially of a water-soluble cationic flocculant.

73. The method of Claim 72 wherein the water-soluble cationic flocculant is selected from the group consisting of a chitosan salt, a cationic N-halochitosan, a cationic gum, a cationic starch, and a cationic polyacrylamide.

74. The method of Claim 38 wherein the flocculant comprises a water-soluble anionic flocculant.

75. The method of Claim 74 wherein the anionic flocculant is selected from the group consisting of an anionic gum, an anionic starch and an anionic polyacrylamide.

76. The method of Claim 38 wherein the flocculant comprises a water-soluble cationic flocculant and a water-soluble anionic flocculant.

77. The method of Claim 76 wherein:

(a) the device body comprises a first half and a second half, and more water-soluble anionic flocculant is disposed within the first half of the body than within the second half of the body; and

(b) the purification device is oriented with respect to the running water so that the running water contacts the first half of the body before contacting the second half of the body.

78. The method of Claim 76 wherein at least 90% of the water-soluble anionic flocculant is disposed within the first half of the body.

79. The method of Claim 76 wherein at least 99% of the water-soluble anionic flocculant is disposed within the first half of the body.